PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-168595

(43)Date of publication of application : 02.07.1993

(51)Int.Cl. A61B 3/10

(21)Application number : 03-343204

(22)Date of filing : 25.12.1991

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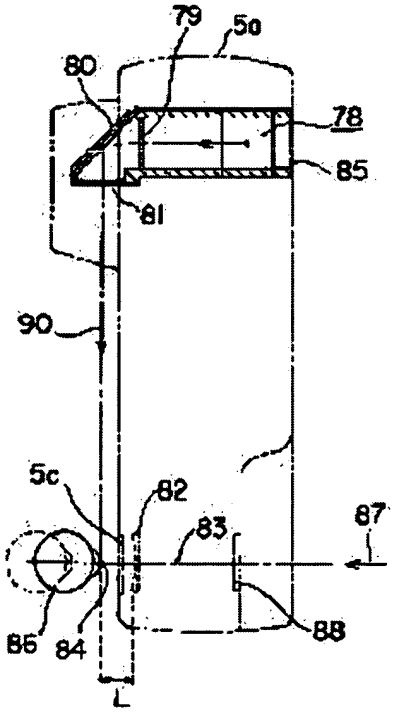
(54) VERTEX ADJUSTING DEVICE AND METHOD OF OPHTHALMIC APPARATUS

(57)Abstract:

PURPOSE: To accurately adjust a vertex to a predetermined value in an ophthal mic apparatus.

CONSTITUTION: When the iris of an eye is irradiated with light, noticing a point where the iris looks bright, laser beam having a cross-sectional area larger than the size of the eye 86 of an examinee is emitted to the point 84 on the optical axis 83 at a predetermined distance from a measuring lens 82 in the direction (arrow 90) vertical to the optical axis of the measuring lens 32. The eye 86 of the examinee is observed through an observation window 88 in the direction shown by an arrow 87 while the distance between the measuring lens 82 and the apex of the cornea of the eye 86 of the examinee is changed and, when the reflected light of the iris generated when the iris of the eye 86 of the examinee is irradiated with laser beam is detected, the change of the distance between the measuring lens 82 and the apex of the cornea of the eye 86 of the examinee is stopped. By this constitution, a vertex can be simply and accurately adjusted to a predetermined value.



LEGAL STATUS

[Date of request for examination] 01.07.1998

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application

converted registration]

[Date of final disposal for application]

[Patent number]	3165207
[Date of registration]	02.03.2001
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES * 、

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to the bar tex adjusting device and the adjustment approach of optometry equipment of adjusting the distance of a measurement lens and the cornea top-most vertices of the eye of an operating personnel-ed to accuracy, about the bar tex adjusting device and the adjustment approach of optometry equipment.
[0002]
[Description of the Prior Art] Generally, glasses are designed on the assumption that the distance of the back side of a lens and the cornea top-most vertices of an eye is a predetermined value [mm], 12 [for example,]. Therefore, after adjusting the distance (this is hereafter called "bar tex") of a measurement lens and the cornea top-most vertices of the eye of an operating personnel-ed to a predetermined value also in optometry equipment at accuracy, it is necessary to examine the eyes.
[0003] Conventionally, there is the frame reliance section by which the frame of an operating personnel-ed is contacted in optometry equipment, it enables it to be manually moved to the cross direction of an operating personnel-ed, and this frame reliance section adjusts bar tex by this. Moreover, the optical-system observation equipment which can observe the eye of an operating personnel-ed from the side of an operating personnel-ed is formed in optometry equipment. This observation equipment has the vertical sight vane equipped with the reference point mark for abolishing the parallax between the pointer scale of the transparence which showed the predetermined location where bar tex becomes a predetermined value in the middle of that optical system, and a pointer scale and the eye of an operating personnel-ed.
[0004] Drawing 12 is drawing showing the situation when seeing the eye of an operating personnel-ed through observation equipment. An operating personnel looks into observation equipment, carries out small migration of the location of its eye, makes the red mark 123 which shows the reference point 121,122 of a vertical sight vane, and the predetermined location of a pointer scale agree, and abolishes parallax. Marks 123a-123d are marks which are prepared in a pointer scale and show the red mark 123 order. The eye of an operating personnel-ed is observed with the agreement condition. The eye of the operating personnel-ed from the side is visible to observation equipment. And the location of the eye of an operating personnel-ed is moved and the cornea top-most vertices 124 of the eye of an operating personnel-ed are made to agree to the red mark 123 of a pointer scale by moving the frame reliance section. It means that bar tex was adjusted to the predetermined value by this.
[0005]
[Problem(s) to be Solved by the Invention] However, although it was required with the observation equipment of conventional optometry equipment for the cornea top-most-vertices location of the eye of an operating personnel-ed to look good to an operating personnel through observation equipment in order to check that the cornea top-most vertices of the eye of an operating personnel-ed agree in the predetermined location of a pointer scale, looking at the cornea top-most-vertices location of the eye of an operating personnel-ed, it could not be clearly seen actually. It is idea **** that light does not reach an eye well even if optometry equipment is equipped with the lighting which illuminates the face of that the lighting of the chamber on which optometry equipment was put is dark as the cause, or an operating personnel-ed etc. Moreover, when a light strong against the eye of an operating personnel-ed was applied to reverse, the problem of ******** also had an operating personnel-ed.
[0006] Moreover, the operating personnel was not easy to maintain the condition that it is necessary to look into observation equipment, to move the location of one's eye, and to abolish parallax, it is necessary to observe the cornea top-most vertices of the eye of an operating personnel-ed with the condition that the parallax does not exist, and there is no parallax for an operating personnel.

[0007] It was a difficult activity that the above thing becomes a cause and adjusts bar tex to a predetermined value with conventional optometry equipment at accuracy. This invention is made in view of such a point, and it aims at offering the bar tex adjusting device and approach of optometry equipment that bar tex can be adjusted to a predetermined value at accuracy.

[0008]

[Means for Solving the Problem] In the bar tex adjusting device of the optometry equipment which has the measuring head section in order to solve the above-mentioned technical problem in this invention A light beam exposure means to turn to the point on said optical axis of a predetermined distance the light beam which has the cross section of a small area compared with the magnitude of the eye of an operating personnel-ed, and to irradiate it from said measurement lens from a direction vertical to the optical axis of a measurement lens, When the reflected light of said iris generated when the distance of the observation port which observes the eye of an operating personnel-ed, and a measurement lens and the cornea top-most vertices of the eye of an operating personnel-ed is changed and said light beam is irradiated by the iris of the eye of an operating personnel-ed is detected, The bar tex adjusting device of the optometry equipment characterized by having a change means to stop change of said distance is offered.

[0009] In the bar tex adjustment approach of optometry equipment a light beam moreover, from a direction vertical to the optical axis of a measurement lens Irradiate towards the point on said optical axis of a predetermined distance from a measurement lens, and the distance of a measurement lens and the cornea top-most vertices of the eye of an operating personnel-ed is changed. When the reflected light of said iris generated when said light beam is irradiated by the iris of the eye of an operating personnel-ed is supervised and the reflected light of said iris is detected, The bar tex adjustment approach of the optometry equipment characterized by stopping change of the distance of said measurement lens and cornea top-most vertices of the eye of an operating personnel-ed is offered.

[0010]

[Function] Paying attention to the point which can shine and be seen, from a direction vertical to the optical axis of a measurement lens, the light beam which has the cross section of a small area compared with the magnitude of the eye of an operating personnel-ed will be turned to the point on said optical axis of a predetermined distance from a measurement lens, and this invention will irradiate it, if light is irradiated by the iris of an eye. On the other hand, when the reflected light of the iris generated when the eye of an operating personnel-ed is observed and said light beam is irradiated by the iris of the eye of an operating personnel-ed is detected changing the distance of a measurement lens and the cornea top-most vertices of the eye of an operating personnel-ed, change of the distance of a measurement lens and the cornea top-most vertices of the eye of an operating personnel-ed is stopped. Thereby, bar tex can be easily adjusted to a predetermined value at accuracy.

[0011]

[Example] Hereafter, one example of this invention is explained based on a drawing. Drawing 2 is the whole optometry equipment block diagram. Optometry equipment consists of the measuring head section 1 equipped with the measurement device of a visual function including the object for **, and the object for **, a measuring head supporter 2 supported for the measuring head section 1, enabling free vertical movement and a free level revolution, the optometry table section 3, and the base section 4 which supports these.

[0012] Drawing 3 is an external view from [of the measuring head section 1 of drawing 2] a tooth back (operating-personnel-ed side). The measuring head section 1 consists of the measurement lens unit section 5 and the PD device section 6. It consists of the unit sections 5a and 5b for right and left, and various kinds of measurement lenses for visual function measurement, such as spherical-surface measurement of the eye of an operating personnel-ed, an astigmometry, astigmatism axonometry, and prism measurement, and an attachment lens are contained, the measurement lens unit section 5 makes various visual field conditions, and optometry has come to be able to do it by combining these lens groups. The measurement lens unit section 5 is hung from PD device section 6, and is lowered, and PD device section 6 builds in the device in which spacing of unit section 5a for the left eyes of the measurement lens unit section 5 and unit section 5b for right eyes is adjusted according to the pupillary distance (PD) of an operating personnel-ed.

[0013] There are measurement apertures 5c and 5d in the unit sections 5a and 5b for the left right eyes of the measurement lens unit section 5, respectively, and the eyes are examined, making an operating personnel-ed look into these measurement apertures 5c and 5d with both eyes, respectively. On the occasion of this optometry, the vertical direction adjustment which makes in agreement with the optical axis of the eye of an operating personnel-ed also to the vertical direction the optical axis of the lens for measurement installed in the measurement apertures 5c and 5d other than adjustment of the above-mentioned pupillary distance, and cross-direction adjustment which adjusts the distance (bar tex) of the lens for measurement and the cornea top-most vertices of the eye of an operating personnel-ed to a predetermined value [mm], 12 [for example,], are performed.

[0014] The supporter material 7 of head means for supporting is fixed to PD device section 6, and the frame reliance member 10 grade in which the frame of cross-direction migration equipment 8 (not shown to drawing 3), vertical migration equipment 9, and an operating personnel-ed is contacted by the supporter material 7 is prepared in it. Cross-direction migration equipment 8 is equipment which moves the frame reliance member 10 to the cross direction of an operating personnel-ed, and adjusts bar tex to a predetermined value, and vertical migration equipment 9 is equipment which makes the optical axis of the lens for measurement in agreement with the optical axis of the eye of an operating personnel-ed to the vertical direction.

[0015] Drawing 4 shows the supporter material 7 of the above-mentioned head means for supporting, cross-direction migration equipment 8, vertical migration equipment 9, and frame reliance member 10 grade, and is the fragmentary sectional view of the A-A side of drawing 3 . The supporter material 7 is a rectangular metal plate, and is being fixed to PD device section 6 with the screw thread (not shown). The fixed bracket 11 ****s in the supporter material 7, and it is fixed to it by 12. Cross-direction migration equipment 8 is attached in the fixed bracket 11. That is, while DC motor 8a which is the driving source of cross-direction migration equipment 8 ****s and being fixed by 8a and 8b, housing 8d ****s to the fixed bracket 11, and it is fixed to it by 8e and 8f. 8g of driving pulleys with a gear tooth is arranged by the output shaft of DC motor 8a. The actuation control unit (it does not illustrate to drawing 4 but illustrates to drawing 6) to which the input unit was connected is electrically connected to DC motor8a.

[0016] Round bar-like screw-thread shaft 8i penetrates housing 8d to housing 8d, and is prepared in it. Subordination pulley 8h with a gear tooth is fixed to the one side of screw-thread shaft 8i, and a male screw is formed in the other side, and thrust-bearing 8j is prepared in pars intermedia. By thrust-bearing 8j, screw-thread shaft 8i can be freely rotated to housing 8d, and moves to a cross direction (longitudinal direction of drawing 4). Between subordination pulley 8h and 8g of driving pulleys, belt 8with gear tooth k is laid.

[0017] Cylinder space with the axial center of screw-thread shaft 8i and an axial center in agreement is established in housing 8d of the neighborhood which screw-thread shaft 8i penetrates, and 8m of migration members of almost a bell shape is inserted in it in this cylinder space. 8m of migration members has a female screw inside, and this female screw engages them to the male screw of screw-thread shaft 8i. 8m of migration members is freely movable to a cross direction (longitudinal direction of drawing 4) to housing 8d, and they are prepared in a hand of cut so that it may not rotate. That is, 8n of key ways is prepared in housing 8d at shaft orientations, and sensor pin 8p which was located in 8n of key ways and which is a key is fixed to 8m of migration members, and it is carried out as [carry out / 8m of migration members can move to a cross direction freely, and / members / by the interaction of 8n of these key ways, and sensor pin 8p / a revolution]. Sensor pin 8p is used for location detection of 8m of migration members. That is, sensor adapter plate 8q is fixed to housing 8d, and the sensors 8r and 8s which detect contiguity of sensor pin 8p are arranged in two predetermined locations of sensor adapter plate 8q. Sensors 8r and 8s are connected to the above-mentioned actuation control unit.

[0018] Sensors 8r and 8s are sensors for detecting the ends marginal location of the movable range of 8m of migration members, and when sensor pin 8p approaches Sensors 8r and 8s, they output a limit signal, respectively. Those limit signals are sent to an actuation control unit, and actuation of DC motor 8a is controlled.

[0019] Vertical migration equipment 9 is attached in the end of 8m of migration members. That is, dummy support 9a whose one side is a flat surface is fixed to the end of 8m of migration members, and ball plunger 9b is laid under the this dummy support 9a. Sheet metal-like click plate 9c is prepared in the vertical direction of drawing 4 free [a slide] to dummy support 9a at the flat-surface side of dummy support 9a. Click plate 9c has four holes, and ball plunger 9b engages with the above-mentioned hole, and it holds click plate 9c by four places. 9d of slide metallic ornaments is joined to click plate 9c, dummy support 9a and click plate 9c are inserted in between, and presser-foot metallic-ornaments 9e slid in the vertical direction with 9d of slide metallic ornaments is fixed to 9d of slide metallic ornaments. 9f of parallel pins which change from the round bar which penetrates 9d of slide metallic ornaments to the longitudinal direction (direction vertical to the space of drawing 4) of an operating personnel-ed to 9d of slide metallic ornaments is prepared. Frame reliance bracket 9g is attached in the ends which projected from 9d of slide metallic ornaments of 9f of this parallel pin free [rotation] centering on the shaft of 9f of parallel pins. The frame reliance member 10 is fixed to frame reliance bracket 9g. The frame reliance member 10 has structure with the flat surface which curved for a while to the longitudinal direction along with the frame of an operating personnel-ed. Furthermore, two coil springs 9h and 9i (refer to drawing 5) are formed in 9d of slide metallic ornaments, and coil springs 9h and 9i energize the frame reliance member 10 to the counterclockwise rotation of drawing 4 centering on the shaft of 9f of parallel pins. The energization force of these coil springs 9h and 9i is adjusted to extent to which the field where the frame of the frame reliance member 10 hits is always parallel mostly to 9d of slide metallic ornaments, when the frame of an operating personnel-ed is contacted by the frame reliance member 10. Therefore, the field where the frame of the frame reliance member 10 hits has become upward for a while with coil springs 9h and 9i, while the frame of an operating personnel-

ed is not contacted, but if the frame of an operating personnel-ed is contacted and reverse is pushed on coil springs 9h and 9i, it will be in a vertical condition mostly.

[0020] Drawing 5 is the side elevation which looked at head means for supporting from the right-hand side of drawing 4 . Drawing 6 is the block diagram showing the configuration of an actuation control device. The actuation control unit 60 consists of a PD head substrate 61 and a Maine control substrate 62, and an input unit 63 is connected to the Maine control substrate 62. The PD head substrate 61 carries the control unit which performs the output control including Sensors 8r and 8s of the various motors of PD device section 6 including the input control of the various sensors of PD device section 6, and DC motor 8a etc. In the PD head substrate 61, the current for normal rotation or reversal is supplied to DC motor 8a according to the command signal of the motorised initiation inputted through the Maine control substrate 62 from an input unit 63, and a halt, and the limit signal from Sensors 8r and 8s. The Maine control substrate 62 carries in drawing the control unit which performs various control of the whole optometry equipment of data communication with the power-source communication link substrate which is not shown, control of a data display system, control of various lamps or a solenoid, control of a mouse, control of a printer, etc. including data communication with the PD head substrate 61.

[0021] Below, actuation of the head means for supporting constituted as mentioned above is explained. First, actuation of cross-direction migration equipment 8 is explained. If the command to which the frame reliance member 10 is moved to the input unit 63 connected to the actuation control unit 60 by the operating personnel at front or the back is given, an actuation current will be supplied to DC motor 8a from the PD head substrate 61. Thereby, DC motor 8a rotates in the direction of either. The revolution is ****ed through the output shaft of DC motor 8a, 8g of driving pulleys, belt 8with gear tooth k, and subordination pulley 8h in order, and is transmitted to shaft 8i. According to an operation of the female screw of the male screw of screw-thread shaft 8i and 8m of migration members, rotation of screw-thread shaft 8i is changed into the rectilinear motion which is 8m of migration members. Therefore, according to the revolution of DC motor 8a, 8m of migration members moves to the cross direction of an operating personnel-ed. By migration to the cross direction of 8m of migration members, the frame reliance member 10 also moves to a cross direction.

[0022] By migration to the cross direction of the frame reliance member 10, when the iris of an operating personnel-ed shines so that it may explain in full detail behind (i.e., when the actual bar tex of an operating personnel-ed which had applied the frame to the frame reliance member 10 becomes a predetermined value), an operating personnel issues the command which makes an input unit 63 suspend migration of the frame reliance member 10. Thereby, the frame reliance member 10 can be adjusted to a desired location.

[0023] In addition, since a limit signal is outputted to the PD head substrate 61 from sensor 8r or sensor 8s when sensor pin 8p approaches sensor 8r or sensor 8s (i.e., when 8m of migration members reaches the ends marginal location of an order successive range), when there is an input of this signal, the PD head substrate 61 suspends supplying an actuation current to DC motor 8a. It is prevented that 8m of migration members moves across the ends marginal location of an order successive range by this.

[0024] Below, actuation of vertical migration equipment 9 is explained. First, the measuring head section 1 of optometry equipment is moved in the vertical direction by the function of the measuring head supporter 2, and the measurement apertures 5c and 5d of the measurement lens unit section 5 are doubled with the location of the eye of an operating personnel-ed. Next, the frame reliance member 10 is moved in the vertical direction to dummy support 9a, and in either of the four locations which carry out a click halt, it adjusts so that the frame reliance member 10 may contact the frame of an operating personnel-ed.

[0025] Below, when bar tex changes with cross-direction migration equipment 8 as mentioned above, a means to detect that bar tex became a predetermined value is explained.

[0026] Drawing 1 is the B-B sectional view of the measurement lens unit section 5 in drawing 2 , and drawing 7 is the C-C sectional view of the measurement lens unit section 5 in drawing 2 . First, in drawing 7 , it is guided in the optical-path configuration section 72, it is condensed with a condenser lens 73, and the light by which outgoing radiation was carried out from the lamp 71 results in a target 75 through a mirror 74. The target 75 has slit 75a, as shown in drawing 8 (C).

[0027] Through a mirror 76, an objective lens 77, a half mirror 78, and a vertical sight vane 79, it moves to drawing 1 and the light which penetrated slit 75a of a target 75 results in the optical axis 83 of the measurement lens 82 prepared in the measurement lens unit section 5 through a mirror 80 and a pointer scale 81 further. The measurement lens 82 counters measurement aperture 5c, and is prepared in the interior of the measurement lens unit section 5. The point 84 that this slit light results in an optical axis 83 is adjusted so that the distance L from the back side of the measurement lens 82 may become a predetermined value [mm], 12 [for example,]. An objective lens 77 is adjusted so that the image of slit 75a of a target 75 may carry out image formation on a point 84, and the sense of a target 75 is installed so

that the longitudinal direction of slit 75a by which image formation is carried out to a point 84 may become in the direction vertical to the space of drawing 1 . Therefore, when slit light is irradiated by the side face of an operating personnel-ed so that it may mention later, slit light is prolonged in the vertical direction of an operating personnel-ed.
[0028] Drawing 8 (A) shows a vertical sight vane 79, and drawing 8 (B) shows a pointer scale 81. In this example, it lets a half mirror 78 pass, and like conventional equipment, the vertical sight vane 79 and the pointer scale 81 are installed so that adjustment of bar tex can be performed also from an observation port 85. Of course, a vertical sight vane 79 and pointer scales 81 are not requirements indispensable for this invention.
[0029] The procedure of detecting bar tex having become a predetermined value is explained below using the bar tex detection means constituted as mentioned above. First, the pupillary distance is adjusted by PD device section 6, and vertical migration of the PD device section 6 is carried out, and the optical axis 83 of the measurement lens 82 of the measurement lens unit section 5 is made in agreement with the optical axis (or optical axis) of the eye 86 of an operating personnel-ed. Next, the frame reliance member 10 is moved with vertical migration equipment 9, and the frame reliance member 10 is made to contact the location where the frame of an operating personnel-ed is suitable. An operating personnel observes the eye 86 of an operating personnel-ed through an observation port 88 from the direction of an arrow head 87 at the same time it drives cross-direction migration equipment 8 as mentioned above and moves the frame reliance member 10 to a cross direction in this condition. Cross-direction migration equipment 8 usually operates so that the frame of an operating personnel-ed may be gradually brought close to the measurement lens unit section 5 from a distant place.
[0030] Drawing 9 (A) shows the eye of the slit light seen from the direction of an arrow head 90 (drawing 1), and an operating personnel-ed. The light which penetrated slit 75a of a target 75 as mentioned above is carrying out image formation to the point 84 on an optical axis 83 as a slit light 89. If the eye 86 of an operating personnel-ed approaches the location of the slit light 89 with cross-direction migration equipment 8 and the slit light 89 is irradiated at the head of the eye 86 of an operating personnel-ed, light will reach the iris through a cornea and the iris of the eye 86 of an operating personnel-ed will shine. That is, as an eye is shown in drawing 9 (B) expressed from the transverse plane, an eye 86 has iris 86a in a core, and this iris 86a has the property reflected strongly, when light is irradiated from the exterior. therefore, if the slit light 89 is irradiated at the head of the eye 86 of an operating personnel-ed, pass a cornea -- iris 86a -- light -- arriving -- a part of iris 86a of the eye 86 of an operating personnel-ed -- it seems that 86aa shone. Therefore, if the operating personnel is observing the eye 86 of an operating personnel-ed through an observation port 88 from the direction of an arrow head 87, the flash with which iris 86a of the eye 86 of an operating personnel-ed shines can be checked, and the flash when the slit light 89 reached at the head of the eye 86 of an operating personnel-ed, i.e., the flash when bar tex became a predetermined value, can be detected in this way. An operating personnel operates an input unit 63 to this flash, and stops actuation of cross-direction migration equipment 8 at it.
[0031] The flash when bar tex became a predetermined value tends [very] to check the detection technique of this bar tex detection means in order to detect brightness by the iris compared with the conventional technique which detects a cornea location. moreover, an operating personnel does not have to carry out parallax doubling and is observing the eye 86 of an operating personnel-ed only through an observation port 88 -- sufficient -- the observation is not affected even if the location of the eye of an operating personnel moves at least a few.
[0032] Slit light is not used for this example, but like conventional equipment, the vertical sight vane 79 and the pointer scale 81 are installed in it so that an operating personnel may observe the location of the cornea top-most vertices of the eye of an operating personnel-ed from an observation port 85 and adjustment of bar tex can also be performed. The procedure of this adjustment is explained using drawing 10 and drawing 11 .
[0033] Drawing 10 corresponds to drawing 1 and drawing 11 is the sectional view of the measurement lens unit section 5 corresponding to drawing 7 . An operating personnel looks into an observation port 85 through the direction of an arrow head 91, moves a little location of its eye, makes in agreement the reference point marks 79a and 79b of a vertical sight vane 79, and red mark 81a (refer to drawing 8) of a pointer scale 81, and abolishes parallax. While it has been a location without the parallax, the eye 86 of an operating personnel-ed is observed, and by actuation of cross-direction migration equipment 8, when the cornea top-most vertices of the eye 86 of an operating personnel-ed move and it agrees in red mark 81a of a pointer scale 81, an operating personnel operates an input unit 63 and stops actuation of cross-direction migration equipment 8. Thereby, bar tex is adjusted to a predetermined value.
[0034] Although light irradiated by the eye of an operating personnel-ed from a side face was made into slit light in the above example, not slit light but a punctiform spot light is not necessarily sufficient. Anyway, the light irradiated by the optical axis 83 should just be a light beam with width of face narrow in optical-axis 83 direction.
[0035] Moreover, although actuation stops when bar tex becomes a predetermined value by actuation to the input device 63 by the operating personnel, cross-direction migration equipment 8 establishes independently the means for stopping which stops actuation of cross-direction migration equipment 8, and when an echo of the iris of the eye of an

operating personnel-ed is detected, it may operate the above-mentioned means for stopping manually automatically.
[0036]
[Effect of the Invention] As explained above, it constituted from this invention so that bar tex might be adjusted to a predetermined value based on the reflected light of the iris generated when a light beam is turned to the point on said optical axis of a predetermined distance from a measurement lens from a direction vertical to the optical axis of a measurement lens, it irradiates and a light beam is irradiated by the iris of the eye of an operating personnel-ed. For this reason, in order to detect brightness by the iris compared with the conventional technique which detects a cornea location, it is very easy to check the flash when bar tex became a predetermined value. moreover, an operating personnel does not have to carry out parallax doubling and is observing the eye of an operating personnel-ed only through an observation port -- sufficient -- the observation is not affected even if the location of the eye of an operating personnel moves at least a few. Therefore, it became possible to adjust bar tex to a predetermined value at accuracy.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The bar tex adjusting device of the optometry equipment which has the measuring head section characterized by providing the following A light beam exposure means to turn to the point on said optical axis of a predetermined distance the light beam which has the cross section of a small area compared with the magnitude of the eye of an operating personnel-ed, and to irradiate it from said measurement lens from a direction vertical to the optical axis of said measurement lens A change means to stop change of said distance when the reflected light of said iris generated when the distance of the observation port which observes the eye of an operating personnel-ed, and a measurement lens and the cornea top-most vertices of the eye of an operating personnel-ed is changed and said light beam is irradiated by the iris of the eye of an operating personnel-ed is detected
[Claim 2] The light beam from said light beam exposure means is the bar tex adjusting device of the optometry equipment according to claim 1 irradiated towards the eye of an operating personnel-ed from the side face of an operating personnel-ed.
[Claim 3] The light beam irradiated from said light beam exposure means is the bar tex adjusting device of the optometry equipment according to claim 2 characterized by being the slit light to which the cross-section configuration extended in the vertical direction of an operating personnel-ed.
[Claim 4] In the bar tex adjustment approach of optometry equipment a light beam from a direction vertical to the optical axis of a measurement lens Irradiate towards the point on said optical axis of a predetermined distance from a measurement lens, and the distance of a measurement lens and the cornea top-most vertices of the eye of an operating personnel-ed is changed. The bar tex adjustment approach of the optometry equipment characterized by what change of the distance of said measurement lens and cornea top-most vertices of the eye of an operating personnel-ed is stopped for when the reflected light of said iris generated when said light beam is irradiated by the iris of the eye of an operating personnel-ed is supervised and the reflected light of said iris is detected.
[Claim 5] Said light beam is the bar tex adjustment approach of the optometry equipment according to claim 4 irradiated towards the eye of an operating personnel-ed from the side face of an operating personnel-ed.
[Claim 6] Said light beam is the bar tex adjustment approach of the optometry equipment according to claim 5 characterized by being the slit light to which the cross-section configuration extended in the vertical direction of an operating personnel-ed.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view of the measurement lens unit section of this invention.
[Drawing 2] It is the whole optometry equipment block diagram.
[Drawing 3] It is an external view from [of the measuring head section of drawing 2] a tooth back (operating-personnel-ed side).
[Drawing 4] It is the fragmentary sectional view showing the supporter material of head means for supporting, cross-direction migration equipment, vertical migration equipment, a frame reliance member, etc.
[Drawing 5] It is the side elevation which looked at head means for supporting from the right-hand side of drawing 4 .
[Drawing 6] It is the block diagram showing the configuration of an actuation control device.
[Drawing 7] It is the C-C sectional view of the measurement lens unit section in drawing 2 .
[Drawing 8] (A) is drawing in which (B) shows a pointer scale and (C) shows a target for a vertical sight vane.
[Drawing 9] (A) is drawing showing the eye as which (B) regarded the eye of the slit light seen from the direction of the arrow head 90 of drawing 1 , and an operating personnel-ed from the transverse plane.
[Drawing 10] It is the sectional view of the measurement lens unit section corresponding to drawing 1 when not using slit light.
[Drawing 11] It is the sectional view of the measurement lens unit section corresponding to drawing 7 when not using slit light.
[Drawing 12] It is drawing showing the situation when seeing the eye of an operating personnel-ed through conventional observation equipment.
[Description of Notations]
1 Measuring Head Section
2 Measuring Head Supporter
3 Optometry Table Section
4 Base Section
5 Measurement Lens Unit Section
6 PD Device Section
7 Supporter Material
8 Cross-Direction Migration Equipment
9 Vertical Migration Equipment
10 Frame Reliance Member
71 Lamp
73 Condenser Lens
74 Mirror
75 Target
75a Slit
76 Mirror
77 Objective Lens
78 Half Mirror
79 Vertical Sight Vane
80 Mirror
81 Pointer Scale
82 Measurement Lens
83 Optical Axis

84 Point

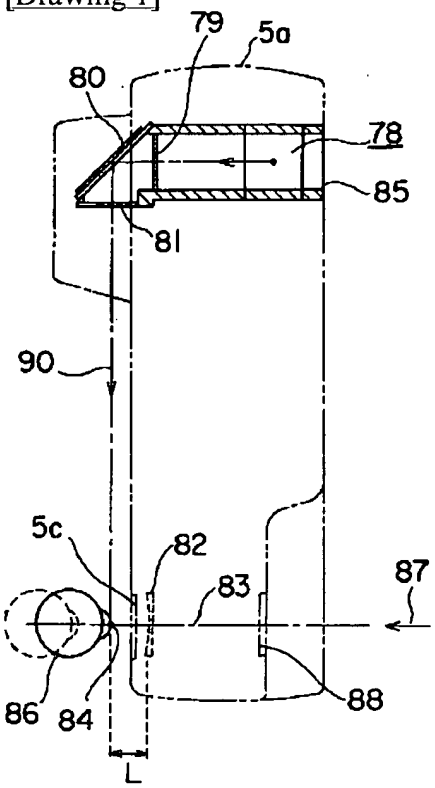
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



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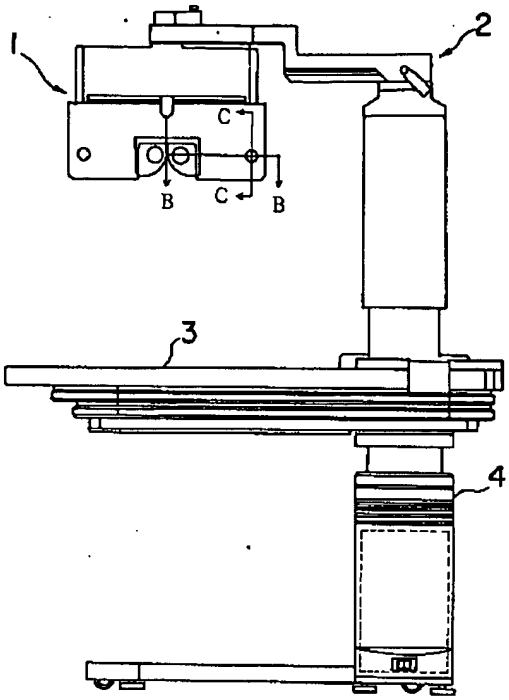

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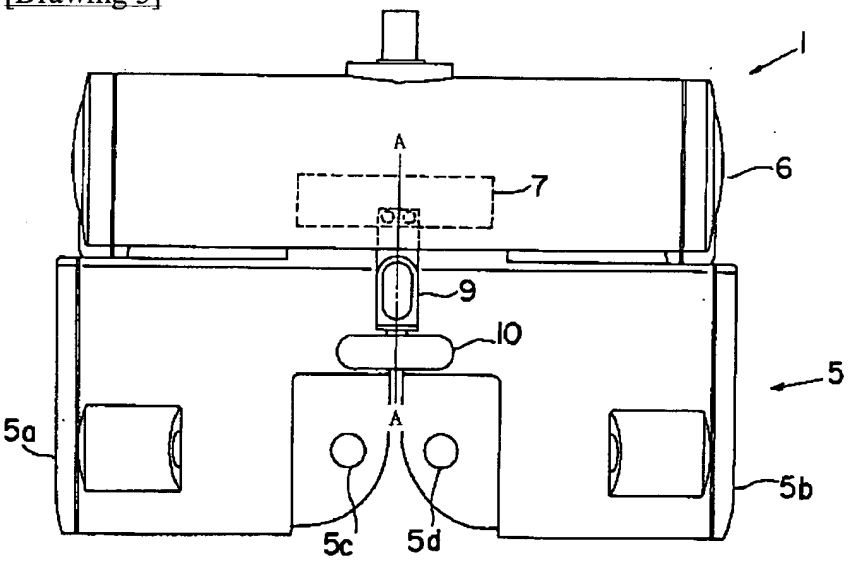

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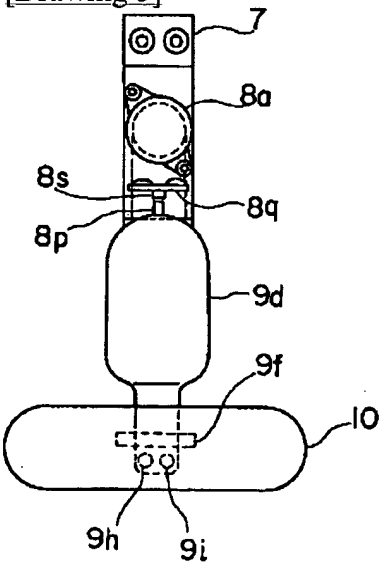

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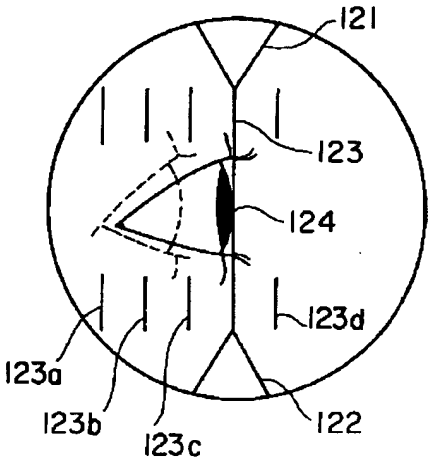

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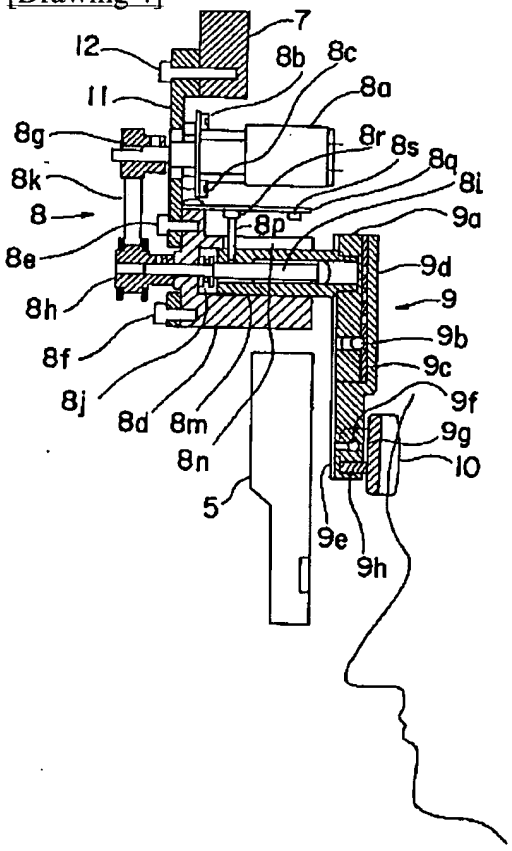

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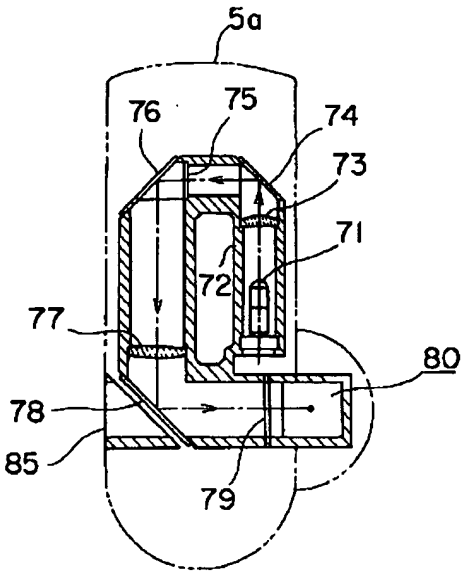

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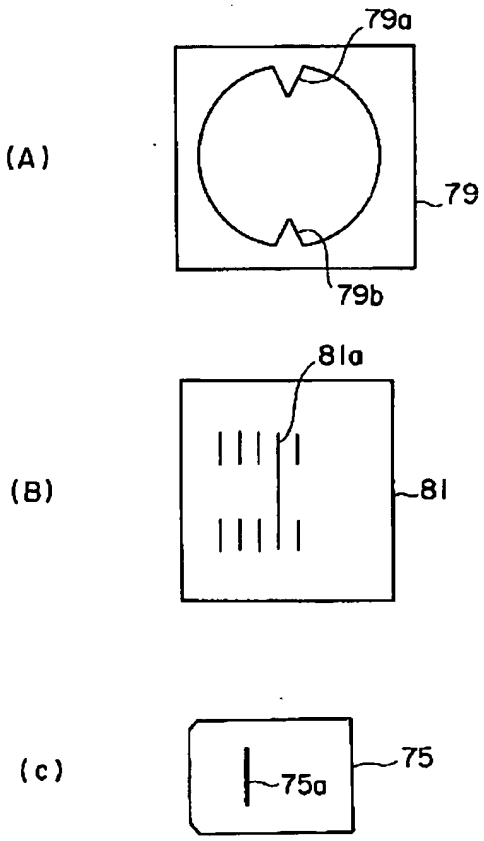

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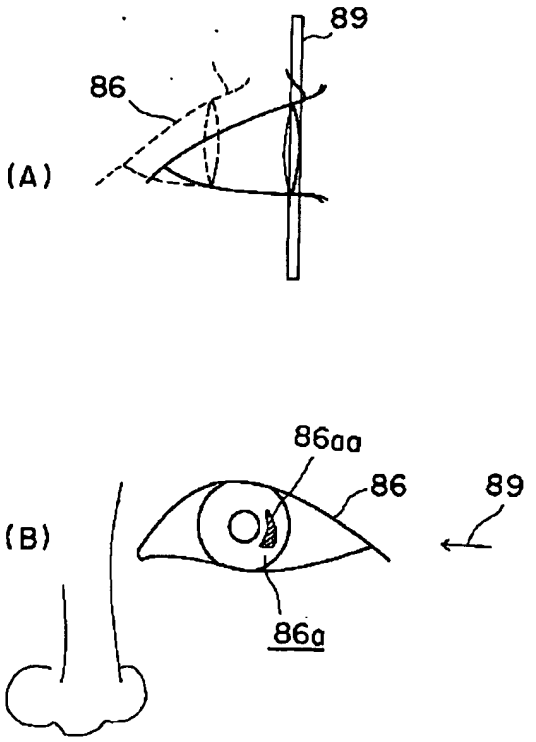
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(A)
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89
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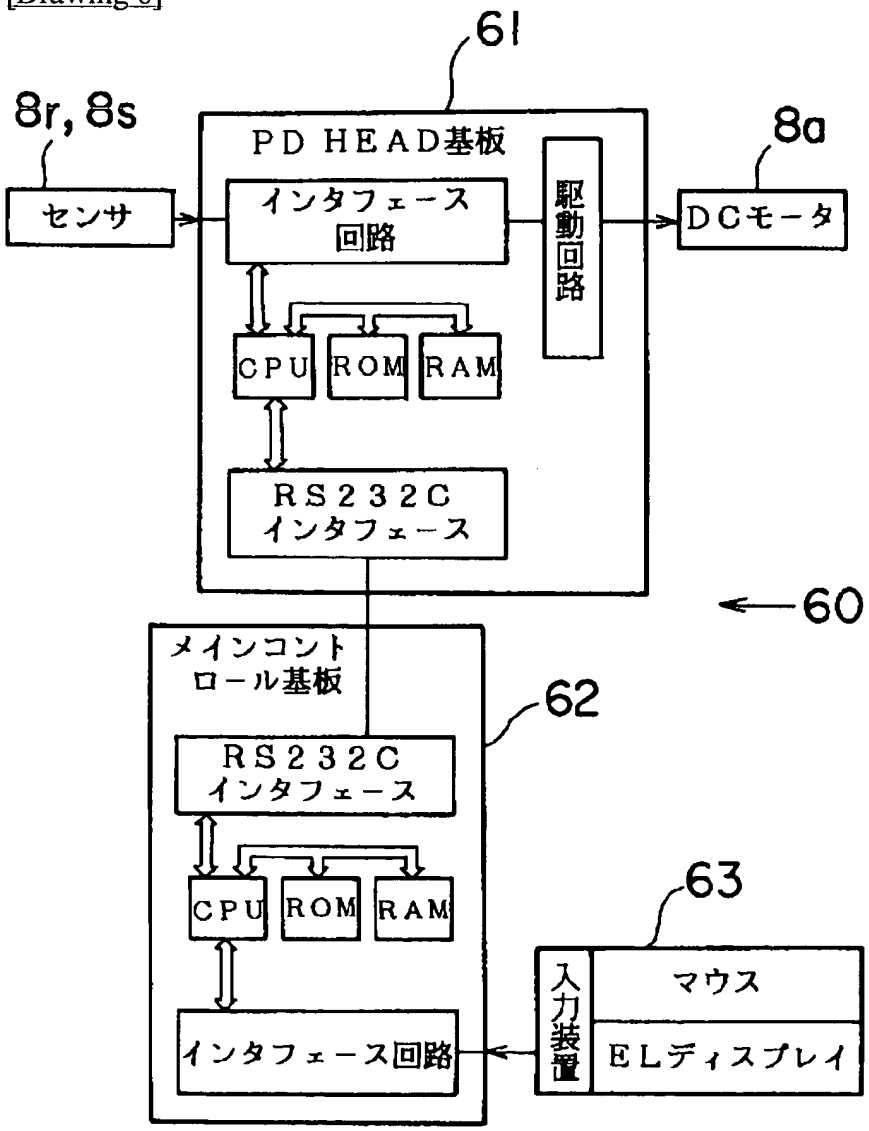
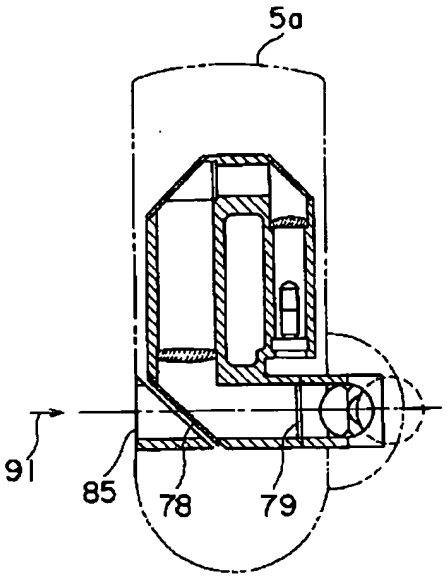
[Drawing 6]


61
8r, 8s
PD HEAD基板
8a
センサ
インタフェース
回路
駆動回路
DCモータ
CPU
ROM
RAM
RS232C
インタフェース
60
メインコント
ロール基板
62
RS232C
インタフェース
CPU
ROM
RAM
63
入力装置
マウス
ELディスプレイ
インタフェース回路

[Drawing 11]



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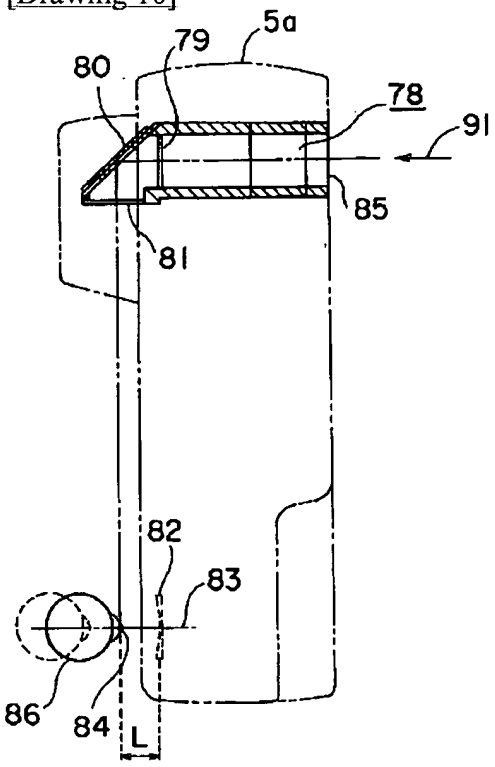

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(19)日本国特許庁（ＪＰ）　(12)**公開特許公報**（Ａ）　(11)特許出願公開番号

特開平5－168595

(43)公開日　平成５年(1993)７月２日

(51)Int.Cl.[5]	識別記号	庁内整理番号	ＦＩ		技術表示箇所
Ａ６１Ｂ　3/10					
		7807－4C	Ａ６１Ｂ	3/ 10	Z
		7807－4C			W

審査請求　未請求　請求項の数６(全 10 頁)

(21)出願番号　特願平3－343204

(22)出願日　平成３年(1991)12月25日

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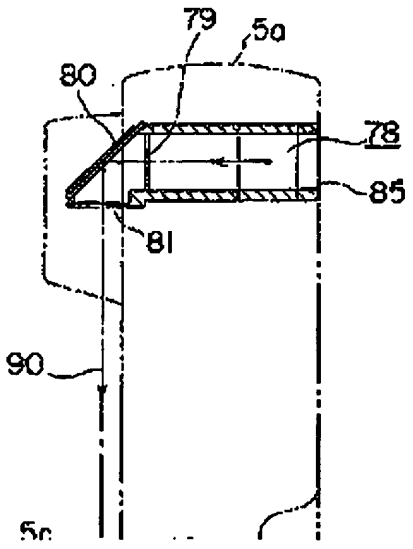
最終頁に続く

(54)【発明の名称】　検眼装置のバーテックス調整装置及び方法

(57)【要約】

【目的】　バーテックスを正確に所定の値に調整できる検眼装置のバーテックス調整装置及び方法を提供することを目的とする。

【構成】　眼の虹彩に光が照射されると、虹彩が縮いて見える点に着目して、被測定者の眼８６の大きさに比べ小さい面積の断面を有する光ビームを、測定レンズ８２の光軸８３に垂直な方向（矢印９０）から、測定レンズ８２から所定の距離の光軸８３上の点８４に向け照射する。一方、測定レンズ８２と被測定者の眼８６の角膜頂点との距離を変化させながら被測定者の眼８６を観察窓８８を通して矢印８７方向から観察し、被測定者の眼８６の虹彩に前記光ビームが照射されたときに発生する虹



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【特許請求の範囲】

【請求項１】　測定ヘッド部を有する検眼装置のバーテックス調整装置において．

被測定者の眼の大きさに比べ小さい面積の断面を有する光ビームを、前記測定レンズの光軸に垂直な方向より、前記測定レンズから所定の距離の前記光軸上の点に向け照射する光ビーム照射手段と、

被測定者の眼を観察する観察窓と、

測定レンズと被測定者の眼の角膜頂点との距離を変化させ．かつ被測定者の眼の虹彩に前記光ビームが照射されたときに発生する前記虹彩の反射光が検出されたとき、前記距離の変化を停止させる変化手段と、

を有することを特徴とする検眼装置のバーテックス調整装置。

【請求項２】　前記光ビーム照射手段からの光ビームは．被測定者の側面から被測定者の眼に向けて照射される請求項１記載の検眼装置のバーテックス調整装置。

【請求項３】　前記光ビーム照射手段から照射される光ビームは、その断面形状が被測定者の上下方向に延びたスリット光であることを特徴とする請求項２記載の検眼装置のバーテックス調整装置。

【請求項４】　検眼装置のバーテックス調整方法において．

光ビームを、測定レンズの光軸に垂直な方向より．測定レンズから所定の距離の前記光軸上の点に向け照射し、測定レンズと被測定者の眼の角膜頂点との距離を変化させ．

被測定者の眼の虹彩に前記光ビームが照射されたときに発生する前記虹彩の反射光が監視され．

前記虹彩の反射光が検出されたとき．前記測定レンズと被測定者の眼の角膜頂点との距離の変化を停止させる、ことを特徴とする検眼装置のバーテックス調整方法。

【請求項５】　前記光ビームは、被測定者の側面から被測定者の眼に向けて照射される請求項４記載の検眼装置のバーテックス調整方法。

【請求項６】　前記光ビームは、その断面形状が被測定者の上下方向に延びたスリット光であることを特徴とする請求項５記載の検眼装置のバーテックス調整方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は検眼装置のバーテックス調整装置および調整方法に関し、特に測定レンズと被測定者の眼の角膜頂点との距離を正確に調整する検眼装置

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の値に調整した上で、検眼を行う必要がある。

【０００３】従来、検眼装置には被測定者の額が当接される額当て部があり、この額当て部が手動で被測定者の前後方向に移動できるようにされていて、これによってバーテックスを調整する。また、検眼装置には被測定者の眼を、被測定者の側方から観察できる光学系観察装置が設けられている。この観察装置は．その光学系の途中に．バーテックスが所定の値になる所定位置を示した透明の目盛り板と．目盛り板と被測定者の眼との間の視差を無くすための．基準点マークを備えた視準板とを有している。

【０００４】図１２は観察装置を通して被測定者の眼を見たときの様子を示す図である。測定者は、観察装置を覗いて自分の眼の位置を僅か移動させて、視準板の基準点１２１，１２２と目盛り板の所定位置を示す赤色マーク１２３とを合致させて視差を無くす。マーク１２３ａ～１２３ｄは．目盛り板に設けられ．赤色マーク１２３の前後を示すマークである。その合致状態のまま．被測定者の眼を観察する。観察装置には．側方からの被測定者の眼が見える。そして．額当て部を移動させることによって被測定者の眼の位置を移動させ．被測定者の眼の角膜頂点１２４を目盛り板の赤色マーク１２３に合致させる。これにより、バーテックスが所定の値に調整されたことになる。

【０００５】

【発明が解決しようとする課題】しかし、従来の検眼装置の観察装置では、被測定者の眼の角膜頂点位置を見ながら．目盛り板の所定位置に被測定者の眼の角膜頂点が合致することを確認するため、被測定者の眼の角膜頂点位置が観察装置を通して測定者によく見えることが必要であったが、実際にはよく見えていなかった。その原因として、検眼装置の置かれた部屋の照明が暗いことや被測定者の顔を照らす照明が検眼装置に備えられていても眼に光がうまく届かないこと等が考えらえる。また、逆に被測定者の眼に強い光を当てると被測定者が眩しがるという問題もあった。

【０００６】また、測定者は、観察装置を覗いて自分の眼の位置を移動させて、視差を無くし．その視差の無い状態のまま、被測定者の眼の角膜頂点を観察する必要があり．測定者にとって視差の無い状態を維持することは容易ではなかった。

【０００７】以上のことが原因になって、従来の検眼装置ではバーテックスを正確に所定の値に調整することは

ックス調整装置において．被測定者の眼の大きさに比べ小さい面積の断面を有する光ビームを．測定レンズの光軸に垂直な方向より、前記測定レンズから所定の距離の前記光軸上の点に向け照射する光ビーム照射手段と、被測定者の眼を観察する観察窓と、測定レンズと被測定者の眼の角膜頂点との距離を変化させ．かつ被測定者の眼の虹彩に前記光ビームが照射されたときに発生する前記虹彩の反射光が検出されたとき、前記距離の変化を停止させる変化手段とを有することを特徴とする検眼装置のバーテックス調整装置が．提供される。

【０００９】また、検眼装置のバーテックス調整方法において、光ビームを、測定レンズの光軸に垂直な方向より．測定レンズから所定の距離の前記光軸上の点に向け照射し、測定レンズと被測定者の眼の角膜頂点との距離を変化させ、被測定者の眼の虹彩に前記光ビームが照射されたときに発生する前記虹彩の反射光が監視され、前記虹彩の反射光が検出されたとき、前記測定レンズと被測定者の眼の角膜頂点との距離の変化を停止させることを特徴とする検眼装置のバーテックス調整方法が．提供される。

【００１０】

【作用】本発明は、眼の虹彩に光が照射されると．虹彩が縞いて見える点に着目して、被測定者の眼の大きさに比べ小さい面積の断面を有する光ビームを、測定レンズの光軸に垂直な方向から．測定レンズから所定の距離の前記光軸上の点に向け照射する。一方．測定レンズと被測定者の眼の角膜頂点との距離を変化させながら被測定者の眼を観察し．被測定者の眼の虹彩に前記光ビームが照射されたときに発生する虹彩の反射光が検出されたとき．測定レンズと被測定者の眼の角膜頂点との距離の変化を停止させる。これにより、簡単に．かつ正確にバーテックスを所定の値に調整できる。

【００１１】

【実施例】以下．本発明の一実施例を図面に基づいて説明する。図２は検眼装置の全体構成図である。検眼装置は．近用及び遠用を含めた視機能の測定機構を備えた測定ヘッド部１と．測定ヘッド部１を上下動、水平回転自在に支持する測定ヘッド支持部２と．検眼テーブル部３と．これらを支持する基体部４とから構成される。

【００１２】図３は、図２の測定ヘッド部１の背面方向（被測定者側）からの外観図である。測定ヘッド部１は．測定レンズユニット部５とＰＤ機構部６とから構成される。測定レンズユニット部５は．左右用のユニット部５ａと右眼用のユニット部５ｂとの間隔を．被測定者の瞳孔間距離（ＰＤ）に応じて調整する機構を内蔵している。

【００１３】測定レンズユニット部５の左右眼用のユニット部５ａ，５ｂにはそれぞれ測定窓５ｃ，５ｄがあり．被測定者に両眼でこの測定窓５ｃ．５ｄをそれぞれ覗かせながら検眼を行う。この検眼に際し、上記の瞳孔間距離の調整の他に、測定窓５ｃ，５ｄに設置される測定用レンズの光軸を被測定者の眼の視軸に上下方向に対しても一致させる上下方向調整や、測定用レンズと被測定者の眼の角膜頂点との距離（バーテックス）を所定の値．例えば１２〔ｍｍ〕に調整する前後方向調整が行われる。

【００１４】ＰＤ機構部６には、頭部支持装置の支持部材７が固定され．支持部材７に前後方向移動装置８（図３には図示せず）、上下移動装置９．被測定者の額が当接される額当て部材１０等が設けられる。前後方向移動装置８は、額当て部材１０を被測定者の前後方向に動かしてバーテックスを所定の値に調整する装置であり、上下移動装置９は．測定用レンズの光軸を被測定者の眼の視軸に、上下方向に対して一致させる装置である。

【００１５】図４は、上記頭部支持装置の支持部材７、前後方向移動装置８、上下移動装置９．額当て部材１０等を示し、図３のＡ－Ａ面の部分断面図である。支持部材７は長方形の金属板であって、ＰＤ機構部６にねじ（図示せず）で固定されている。支持部材７には．固定ブラケット１１がねじ１２で固定される。固定ブラケット１１には前後方向移動装置８が取り付けられる。すなわち．固定ブラケット１１には、前後方向移動装置８の駆動源である．ＤＣモータ８ａがねじ８ａ，８ｂで固定されるとともに．ハウジング８ｄがねじ８ｅ，８ｆで固定される。ＤＣモータ８ａの出力軸には歯付きの駆動プーリ８ｇが配設される。ＤＣモータ８ａには、入力装置が接続された駆動制御装置（図４には図示せず．図６に図示する）が電気的に接続される。

【００１６】ハウジング８ｄには丸棒状のねじ軸８ｉが．ハウジング８ｄを貫通して設けられる。ねじ軸８ｉの一方側には歯付きの従属プーリ８ｈが固定され．他方側には雄ねじが設けられ．かつ中間部にスラストベアリング８ｊが設けられる。スラストベアリング８ｊにより．ねじ軸８ｉはハウジング８ｄに対し回転自在であり．かつ前後方向（図４の左右方向）には移動しないようになっている。従属プーリ８ｈと駆動プーリ８ｇとの

向）に移動自在であり、かつ回転方向には回転しないように設けられる。すなわち、ハウジング８ｄには軸方向にキー溝８ｎが設けられ、また、移動部材８ｍにはキー溝８ｎに位置したキーであるセンサピン８ｐが固定され、これらキー溝８ｎおよびセンサピン８ｐの相互作用により、移動部材８ｍが、前後方向には移動自在で、回転はしないようされる。センサピン８ｐは移動部材８ｍの位置検出用にも用いられる。すなわち、ハウジング８ｄにはセンサ取り付け板８ｑが固定され、センサ取り付け板８ｑの２つの所定位置に、センサピン８ｐの近接を検知するセンサ８ｒ，８ｓが配設される。センサ８ｒ，８ｓは上記駆動制御装置に接続される。

【００１８】センサ８ｒ，８ｓは、移動部材８ｍの移動可能範囲の両端限界位置を検出するためのセンサであり、センサピン８ｐがセンサ８ｒ，８ｓに近接することにより、それぞれリミット信号を出力する。それらのリミット信号は駆動制御装置に送られ、ＤＣモータ８ａの駆動が制御されるようになっている。

【００１９】移動部材８ｍの一端には上下移動装置９が取り付けられる。すなわち、移動部材８ｍの一端には、片面が平面である支持金具９ａが固定され、この支持金具９ａにはボールプランジャ９ｂが埋設される。支持金具９ａの平面側には、薄板状のクリック板９ｃが、支持金具９ａに対し図４の上下方向にスライド自在に設けられる。クリック板９ｃは４つの穴を有し、ボールプランジャ９ｂが上記穴に係合してクリック板９ｃを４か所で保持する。クリック板９ｃにはスライド金具９ｄが接合され、スライド金具９ｄには、支持金具９ａおよびクリック板９ｃを間に挟んで、スライド金具９ｄと共に上下方向にスライドする押さえ金具９ｅが固定される。スライド金具９ｄには、スライド金具９ｄを、被測定者の左右方向（図４の紙面に垂直な方向）に貫通する丸穴から成る平行ピン９ｆが設けられる。この平行ピン９ｆのスライド金具９ｄから突出した両端に、平行ピン９ｆの軸を中心に回動自在に額当てブラケット９ｇを取り付ける。額当てブラケット９ｇには額当て部材１０が固定される。額当て部材１０は、被測定者の額に沿って左右方向に少し湾曲した平面を有した構造を有している。さらに、スライド金具９ｄには、２つのコイルバネ９ｈ，９ｉ（図５参照）が設けられ、コイルバネ９ｈ，９ｉは額当て部材１０を、平行ピン９ｆの軸を中心に図４の反時計方向に付勢する。これらのコイルバネ９ｈ，９ｉの付勢力は、被測定者の額が額当て部材１０に当接されたとき

【００２０】図５は、頭部支持装置を図４の右側から見た側面図である。図６は駆動制御装置の構成を示すブロック図である。駆動制御装置６０はＰＤヘッド基板６１とメインコントロール基板６２とから構成され、メインコントロール基板６２には入力装置６３が接続される。ＰＤヘッド基板６１は、センサ８ｒ，８ｓを含めた、ＰＤ機構部６の各種センサの入力制御、ＤＣモータ８ａを含めた、ＰＤ機構部６の各種モータの出力制御等を行う制御装置を搭載している。ＰＤヘッド基板６１では、入力装置６３からメインコントロール基板６２を介して入力されるモータ駆動の開始および停止の指令信号およびセンサ８ｒ，８ｓからのリミット信号に従い、ＤＣモータ８ａに正転または反転用の電流を供給している。メインコントロール基板６２は、ＰＤヘッド基板６１とのデータ通信を含め、図には示さない電源通信基板とのデータ通信、データ表示装置の制御、各種ランプやソレノイドの制御、マウスの制御、プリンタの制御等の、検眼装置全体の各種制御を行う制御装置を搭載している。

【００２１】つぎに、以上のように構成される頭部支持装置の作動を説明する。まず、前後方向移動装置８の作動を説明する。駆動制御装置６０に接続された入力装置６３に、測定者によって額当て部材１０を前方向または後方向に動かす指令が与えられると、ＰＤヘッド基板６１からＤＣモータ８ａに駆動電流が供給される。これによりＤＣモータ８ａがいずれかの方向に回転する。その回転はＤＣモータ８ａの出力軸、駆動プーリ８ｇ、歯付ベルト８ｋ、従動プーリ８ｈを順に介してねじ軸８ｉに伝達される。ねじ軸８ｉの雄ネジおよび移動部材８ｍの雌ネジの作用により、ねじ軸８ｉの回転運動が移動部材８ｍの直線運動に変換される。したがって、ＤＣモータ８ａの回転に応じて移動部材８ｍが被測定者の前後方向に移動する。移動部材８ｍの前後方向への移動で、額当て部材１０も前後方向へ移動する。

【００２２】額当て部材１０の前後方向への移動によって、後に詳述するように、被測定者の虹彩が適いたとき、すなわち、額当て部材１０に額を当てていた被測定者の実際のバーテックスが所定の値になったときに、測定者が入力装置６３に、額当て部材１０の移動を停止させる指令を出すようにする。これにより額当て部材１０を所望の位置に調整することができる。

【００２３】なお、センサピン８ｐがセンサ８ｒまたはセンサ８ｓに近接したとき、すなわち、移動部材８ｍが前後移動範囲の両端限界位置に至ったときには、センサ

る。まず、検眼装置の測定ヘッド部１を測定ヘッド支持部２の機能により上下方向に移動して、測定レンズユニット部５の測定窓５ｃ，５ｄを被測定者の眼の位置に合わせる。つぎに、額当て部材１０を支持金具９ａに対し上下方向に動かし、クリック停止する４つの位置のうちのいずれかで、額当て部材１０が被測定者の額に当接するように調整する。

【００２５】つぎに、以上のように前後方向移動装置８によってバーテックスが変化されたときに、バーテックスが所定の値になったことを検出する手段について説明する。

【００２６】図１は図２における測定レンズユニット部５のＢ－Ｂ断面図であり、図７は図２における測定レンズユニット部５のＣ－Ｃ断面図である。まず、図７において、ランプ７１から出射された光は、光路構成部７２でガイドされ、集光レンズ７３で集光されてミラー７４を経てターゲット７５に至る。ターゲット７５は図８（Ｃ）に示すようにスリット７５ａを有している。

【００２７】ターゲット７５のスリット７５ａを透過した光は、ミラー７６、対物レンズ７７、ハーフミラー７８、視準板７９を介し、図１に移って、さらに、ミラー８０、目盛り板８１を介して、測定レンズユニット部５に設けられた測定レンズ８２の光軸８３に至る。測定レンズ８２は測定窓５ｃに対向して測定レンズユニット部５の内部に設けられている。このスリット光が光軸８３に至る点８４は、測定レンズ８２のバック面からの距離Ｌが所定の値、例えば１２〔ｍｍ〕になるように調整される。対物レンズ７７は、ターゲット７５のスリット７５ａの像が点８４上に結像するように調整され、かつ、ターゲット７５の向きは、点８４に結像されるスリット７５ａの長手方向が図１の紙面に垂直な方向になるように設置される。したがって、後述するように、スリット光が被測定者の側面に照射されたとき、スリット光は被測定者の上下方向に延びている。

【００２８】図８（Ａ）は視準板７９を、図８（Ｂ）は目盛り板８１を示す。本実施例では、ハーフミラー７８を通して、従来の装置のように、観察窓８５からもバーテックスの調整ができるように、視準板７９および目盛り板８１を設置している。勿論、視準板７９および目盛り板８１は、本発明にとって必須の要件ではない。

【００２９】以上のように構成されるバーテックス検出手段を用いて、バーテックスが所定の値になったことを検出する手順をつぎに説明する。まず、ＰＤ駆動部６に

させると同時に、測定者は矢印８７の方向から観察窓８８を通して被測定者の眼８６を観察する。前後方向移動装置８は、通常、被測定者の額を遠方から次第に測定レンズユニット部５に近づけるように作動する。

【００３０】図９（Ａ）は、矢印９０（図１）の方向から見たスリット光および被測定者の眼を示す。上述のようにターゲット７５のスリット７５ａを透過した光が光軸８３上の点８４にスリット光８９として結像している。そのスリット光８９の位置に前後方向移動装置８により被測定者の眼８６が近づき、被測定者の眼８６の先端にスリット光８９が照射されると、角膜を経て虹彩に光が届き被測定者の眼８６の虹彩が輝く。すなわち、眼を正面から表した図９（Ｂ）に示すように、眼８６は中心部に虹彩８６ａがあり、この虹彩８６ａは、外部から光が照射されると強く反射する性質がある。そのため、スリット光８９が被測定者の眼８６の先端に照射されると、角膜を経て虹彩８６ａに光が届き被測定者の眼８６の虹彩８６ａの一部８６ａａが輝いたように見える。したがって、測定者が矢印８７の方向から観察窓８８を通して被測定者の眼８６を観察していれば、被測定者の眼８６の虹彩８６ａが輝く瞬間を確認でき、かくして、スリット光８９が被測定者の眼８６の先端に到達した瞬間、すなわち、バーテックスが所定の値になった瞬間を検出できる。この瞬間に測定者は入力装置６３を操作して前後方向移動装置８の作動を停止させる。

【００３１】このバーテックス検出手段の検出手法は、角膜位置を検出する従来手法に比べ、虹彩の輝きを検出するため、バーテックスが所定の値になった瞬間が非常に確認し易い。また、測定者は、視差合わせをする必要がなく、単に観察窓８８を通して被測定者の眼８６を観察しているだけでよく、測定者の眼の位置が少しぐらい移動してもその観察に影響は出ない。

【００３２】本実施例には、スリット光を使用せず、従来の装置のように、観察窓８５から測定者が被測定者の眼の角膜頂点の位置を観察してバーテックスの調整もできるように、視準板７９および目盛り板８１を設置している。この調整の手順を図１０、図１１を用いて説明する。

【００３３】図１０は図１に対応し、図１１は図７に対応する測定レンズユニット部５の断面図である。測定者は矢印９１の方向から観察窓８５を覗き、自分の眼の位置を少し移動して視準板７９の基準点マーク７９ａ，７９ｂと目盛り板８１の赤色マーク８１ａ（図８参照）と

【００３４】以上の実施例では、被測定者の眼に側面から照射される光をスリット光としたが、必ずしもスリット光ではなく、点状のスポット光でもよい。いずれにしても光軸８３に照射される光は光軸８３方向には幅の狭い光ビームであればよい。

【００３５】また、前後方向移動装置８は、測定者による入力装置６３への操作により、バーテックスが所定の値になったとき、作動が停止するようになっているが、別に、前後方向移動装置８の作動を停止させる停止手段を設け、被測定者の眼の虹彩の反射が検出されたときに自動的にまたは手動で上記停止手段を作動させてもよい。

【００３６】

【発明の効果】以上説明したように本発明では、光ビームを、測定レンズの光軸に垂直な方向より、測定レンズから所定の距離の前記光軸上の点に向け照射し、被測定者の眼の虹彩に光ビームが照射されたときに発生する虹彩の反射光に基づきバーテックスを所定の値に調整するように構成した。このため、角膜位置を検出する従来手法に比べ、虹彩の輝きを検出するため、バーテックスが所定の値になった瞬間が非常に確認し易い。また、測定者は、視差合わせをする必要がなく、単に観察窓を通して被測定者の眼を観察しているだけでよく、測定者の眼の位置が少しぐらい移動してもその観察に影響は出ない。したがって、バーテックスを正確に所定の値に調整することが可能になった。

【図面の簡単な説明】

【図１】本発明の測定レンズユニット部の断面図である。

【図２】検眼装置の全体構成図である。

【図３】図２の測定ヘッド部の背面方向（被測定者側）からの外観図である。

【図４】頭部支持装置の支持部材、前後方向移動装置、上下移動装置、額当て部材等を示す部分断面図である。

【図５】頭部支持装置を図４の右側から見た側面図である。

【図６】駆動制御装置の構成を示すブロック図である。

【図７】図２における測定レンズユニット部のＣ－Ｃ断面図である。

【図８】（Ａ）は視準板を、（Ｂ）は目盛り板を、（Ｃ）はターゲットを示す図である。

【図９】（Ａ）は図１の矢印９０の方向から見たスリット光および被測定者の眼を、（Ｂ）は正面から見た眼を示す図である。

【図１０】スリット光を使わないときの図１に対応する測定レンズユニット部の断面図である。

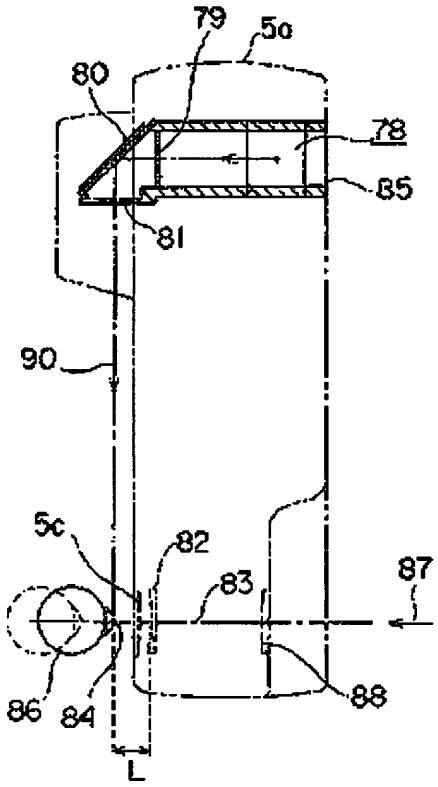
【図１１】スリット光を使わないときの図７に対応する測定レンズユニット部の断面図である。

【図１２】従来の観察装置を通して被測定者の眼を見たときの様子を示す図である。

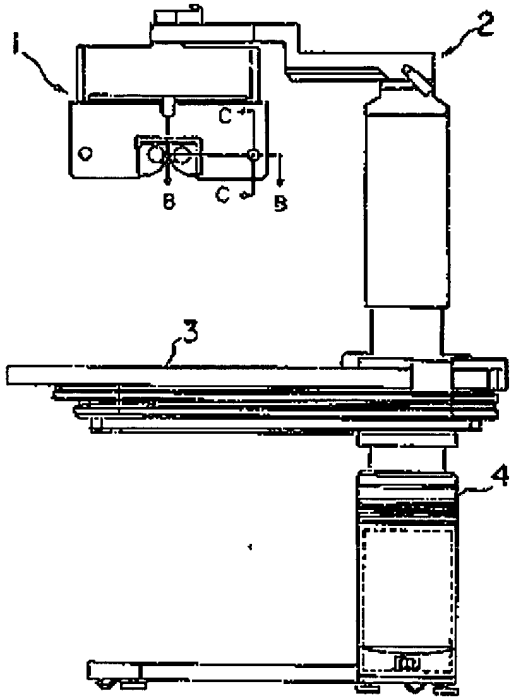
【符号の説明】

１　測定ヘッド部
２　測定ヘッド支持部
３　検眼テーブル部
４　基体部
５　測定レンズユニット部
６　ＰＤ機構部
７　支持部材
８　前後方向移動装置
９　上下移動装置
１０　額当て部材
７１　ランプ
７３　集光レンズ
７４　ミラー
７５　ターゲット
７５ａ　スリット
７６　ミラー
７７　対物レンズ
７８　ハーフミラー
７９　視準板
８０　ミラー
８１　目盛り板
８２　測定レンズ
８３　光軸
８４　点

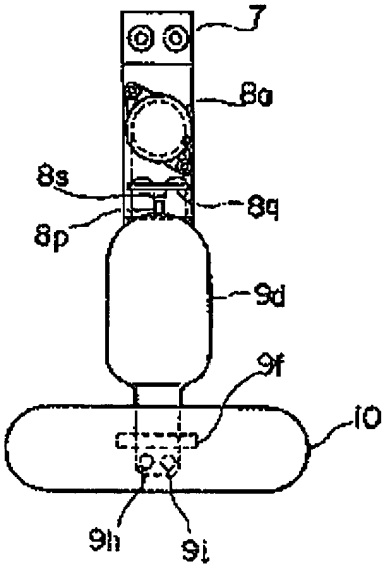
【図1】



【図2】

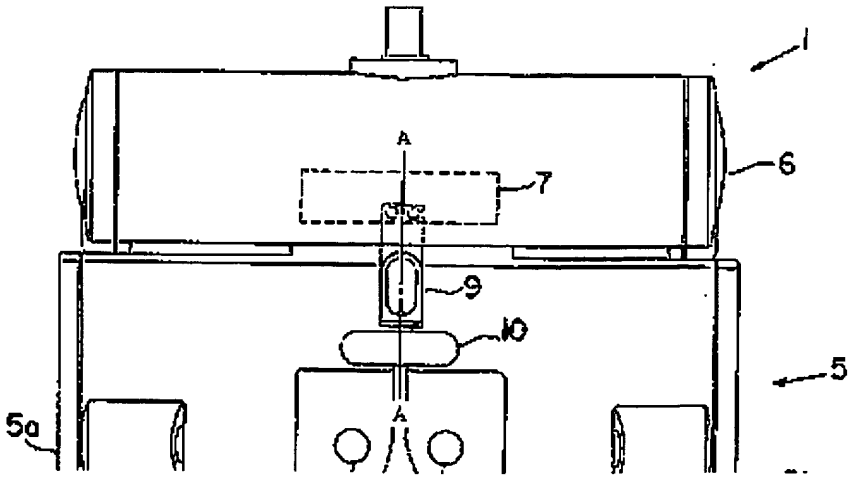


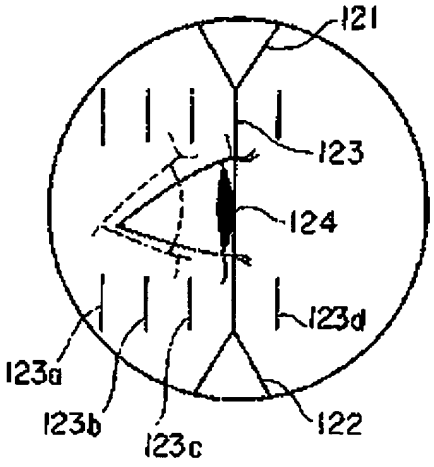
【図5】



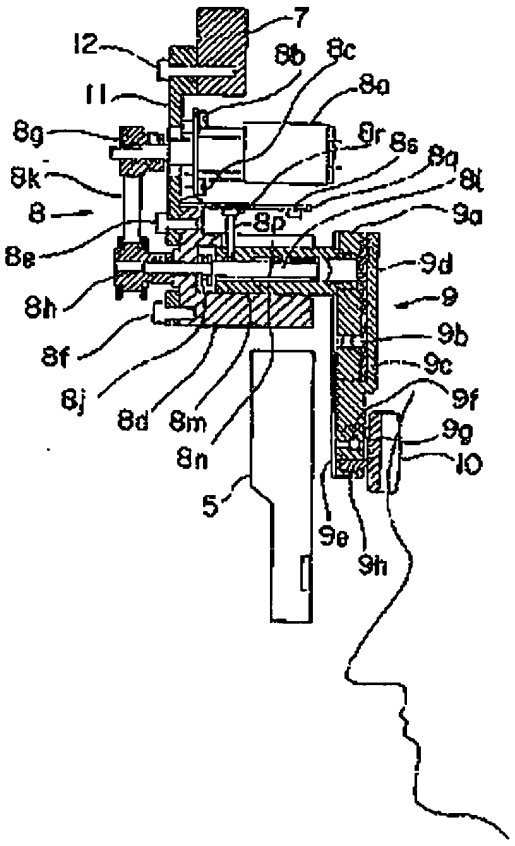
【図12】

【図3】

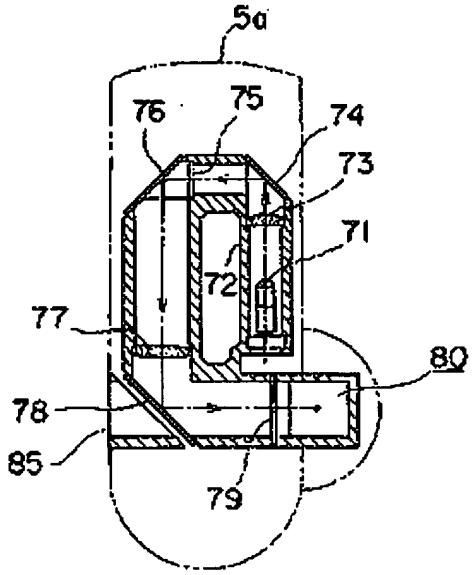




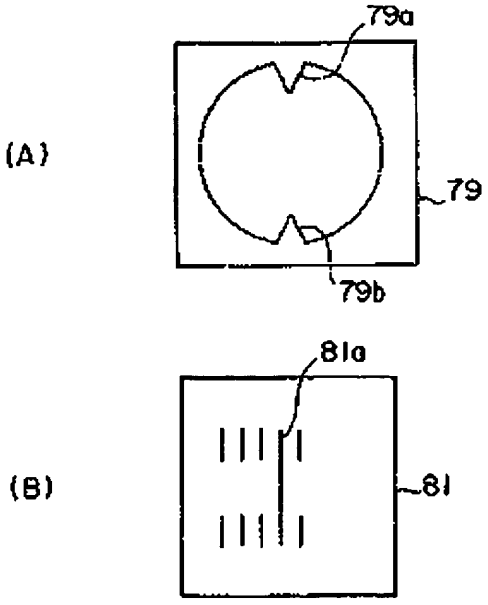
【図4】


12
7
8b
8c
11
8a
8g
8r
8s
8q
8t
8k
8
8p
9a
8e
9d
9
8h
9b
8f
9c
8j
8d
8m
9f
8n
9g
10
5
9e
9h

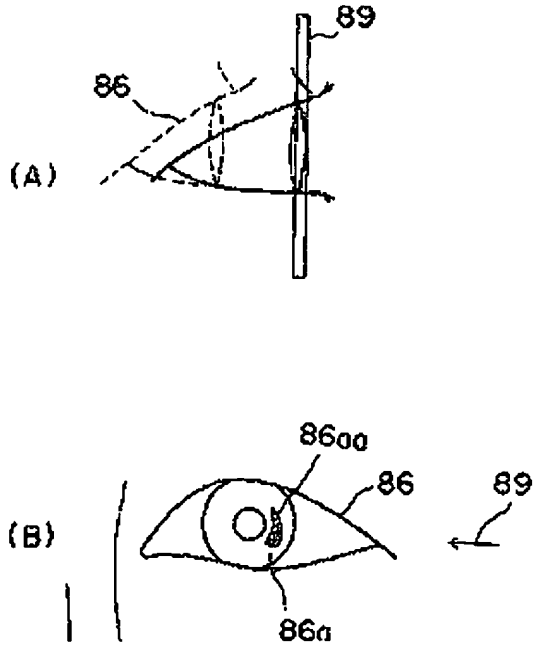
【図7】


5a
76
75
74
73
71
72
77
80
78
85
79

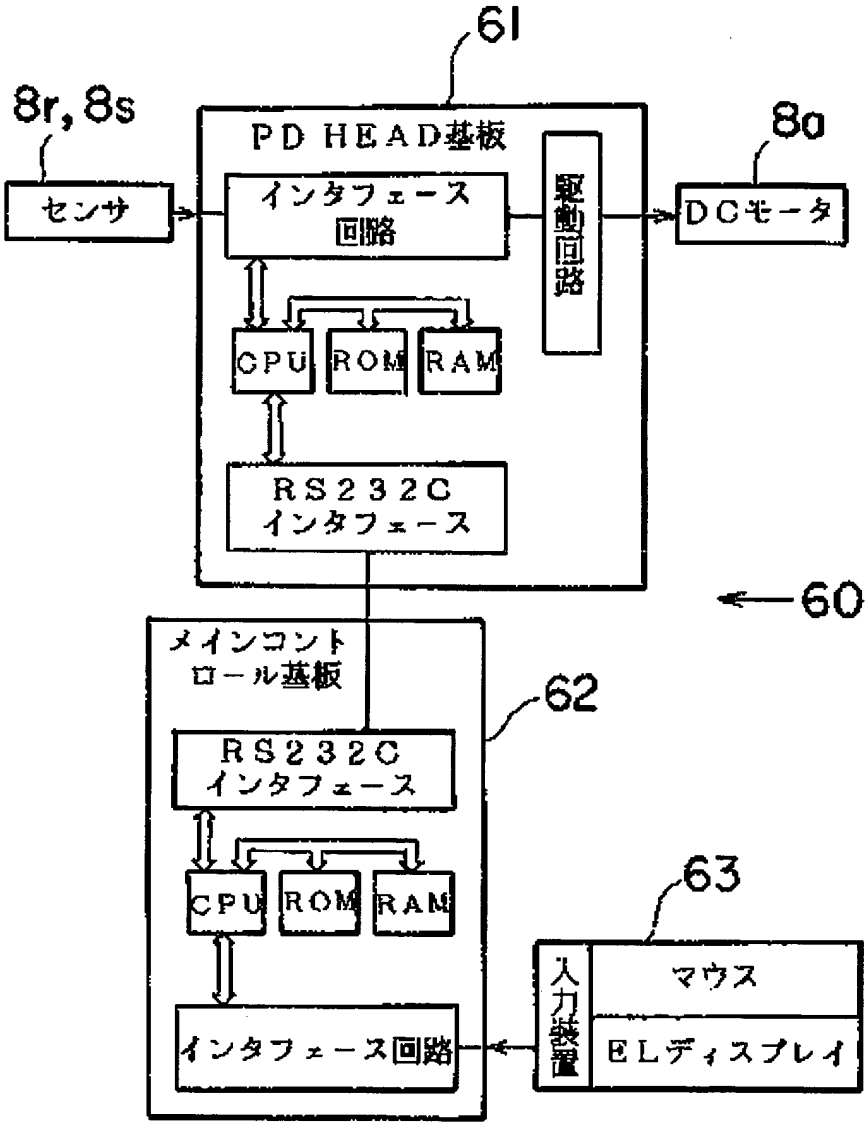
【図8】


(A)
79a
79
79b
(B)
81a
81

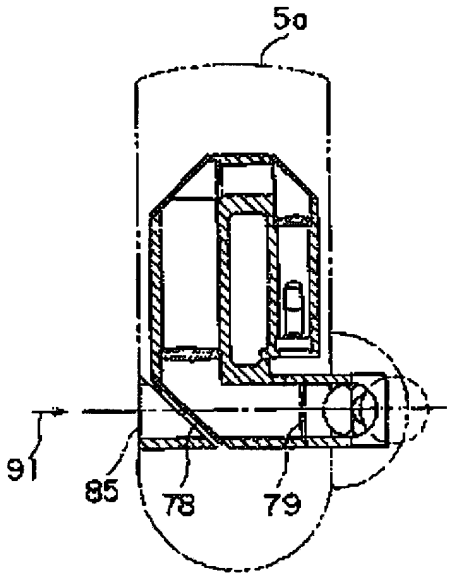
【図9】


89
86
(A)
86aa
86
89
(B)
86a

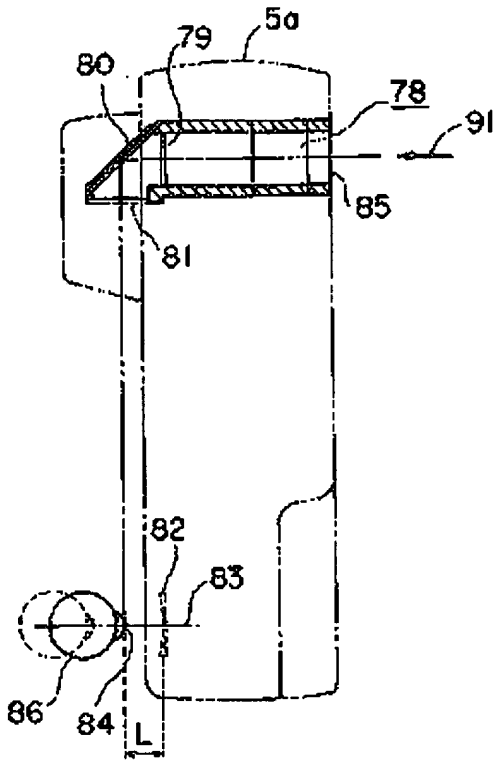
【図6】


61
8r, 8s
PD HEAD基板
センサ
インタフェース回路
駆動回路
8o
DCモータ
CPU
ROM
RAM
RS232C インタフェース
60
メインコントロール基板
62
RS232C インタフェース
CPU
ROM
RAM
63
入力装置
マウス
ELディスプレイ
インタフェース回路

【図11】


5o
91
85
78
79

【図10】



フロントページの続き

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